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"THE DOCTOR'S DILEMMA" OR MEDICAL ETHICS IN PEACE AND WAR[1]

By Professor EDWIN G. CONKLIN

PROFESSOR EMERITUS, PRINCETON UNIVERSITY, PRESIDENT OF THE AMERICAN PHILOSOPHICAL SOCIETY

Some thirty years ago George Bernard Shaw, the famous English author and playwright, published a play entitled "The Doctor's Dilemma," which, like Molière's play, "Le Médecin malgré lui," has had a long and successful run on the stage. As in most of Shaw's published plays there is here a preface as long as the play itself in which the author condemns in wild but witty phrases current social conventions, and advocates Shavian Socialism as a cure-all. In "The Doctor's Dilemma" his unreal and emotional attack on medicine and science in general has just enough of truth in it to make it take with the general public. He denounces current medical ethics, pours contempt on the conscience of doctors, their assumed infallibility, their mercenary motives, their craze for surgical operations. He declares that doctors are not scientists, but pill dispensers and saw-bones; he denounces vivisection, and goes so far as to declare that bacteriology is a superstition, vaccination a craze, inoculations a public peril, and that doctors in general are animated with primitive savage and cruel motives. Finally the only remedy for this sad state of affairs is the "social solution" or the socialization of medicine.

The public, who see only the play on the stage and do not read the preface of the printed book, miss much of this diatribe, but they see Dr. Ridgeon of the play and his apprentice acting the part of Satan in the tangled human relations of greed *vs.* generosity, lust *vs.* love and murder *vs.* mercy.

My purpose in calling attention on this occasion to this and other absurd misrepresentations and exaggerations of the lack of ethics on the part of medical men is to contrast the high level of genuine medical

[1] Address at the graduation exercises in medicine, University of Pennsylvania, December 22, 1943.

ethics with the low level of social ethics in general. It has been popular for a long time in stage plays, such as "Le Médicin malgré lui," "The man who married a dumb wife," and many others, to poke fun at the pretensions and foibles of doctors and to shower contempt on their so-called ethics, but in reality the ethics of the medical profession in general is far and away higher and more ideal than the ethics of society as a whole, and it is certainly more realistic and at the same time more idealistic than that of any other profession, unless it be that of the minister of religion. From the beginnings of Greek medicine in the fifth century B.C. down to modern times the "Hippocratic Oath," named after Hippocrates, "The Father of Medicine," was taken by all persons entering upon the practice of medicine. This oath, in translation, reads in part:

> I swear by Apollo physician, and by Asklepias god of healing, and by all the gods and goddesses:
> To regard my teachers as equal to my parents.
> To help the sick according to my ability and judgment, but never to injure or wrong them.
> Not to give poison to any one, nor to cause abortion, but in purity and holiness to guard my life and art.
> Into whatsoever house I enter I will do so to help the sick, keeping myself free from intentional wrong-doing and harm.
> Whatsoever in the course of practice I see or hear that ought never to be published abroad, I will not divulge.
> Now if I keep this oath and break it not may I enjoy honor in my life and art among all men for all time;
> But if I transgress and foreswear myself may the opposite befall me.

Here is certainly a highly ethical professional code, and although candidates in medicine may not now be required to take this "Oath of Hippocrates," the profession as a whole is pledged to save life and to ease pain wherever this is possible, whether among friends or foes. The saving of life, like the saving of souls, is so much more important and vital than the saving of property or of social pride or of class and national prestige, that violations of humanitarian ethics on the part of physicians or ministers of religion are regarded as more reprehensible than in business or law or statecraft. The profession of medicine, like that of religion, is a humanitarian and holy calling and its ethical code is correspondingly high. These humanitarian professions point the way to better social and moral relations in all phases of society in the world to come after this great crisis in human history.

The contrast between the broad humanism of medicine and "the inhumanity of man to man" in many other social relations is most striking in times of war or preparation for war when the ethics of conflict justifies the wholesale slaughter of enemies and the saving and protection of friends only. This great contrast was nobly stated by Louis Pasteur, whom the French people have voted the greatest of Frenchmen, greater even than Napoleon, and of whom Sir William Osler, once professor of medicine in this university, said, "He was the most perfect man who ever entered the kingdom of science." Pasteur said in the concluding paragraph of his oration at the dedication of the Pasteur Institute in Paris on November 14, 1888:

> Two contrary laws seem to be wrestling with each other nowadays; the one a law of blood and death, ever imagining new means of destruction and forcing nations to be constantly ready for the battle field—the other a law of peace, work and health ever evolving new means of delivering man from the scourges which beset him. The one seeks violent conquests, the other the relief of humanity. The latter places one human life above any victory; while the former would sacrifice hundreds and thousands of lives to the ambition of one. The law of which we are the instruments seeks, even in the midst of conflict, to cure the sanguinary ills of the law of war; the treatment inspired by our antiseptic methods may preserve thousands of soldiers. Which of these two laws will ultimately prevail, God alone knows. But we may assert that French Science will have tried, by obeying the law of Humanity, to extend the frontiers of Life.

The law of humanity *vs.* the law of the jungle, the law of peace *vs.* the law of war, the law of health *vs.* the law of disease, the law of life *vs.* the law of death —there are no greater contrasts than these in all nature and in all human affairs! In all these opposing laws, ideals and goals, medicine is always on the side of humanity and the angels. Even in the midst of wars of the utmost destruction and even of wholesale extermination of armies, cities and nations, medicine has not heretofore been employed to destroy life but only to save it. There have been proposals to spread epidemics of diseases, to shower enemy armies and peoples with pathogenic bacteria and viruses, to poison food and water supplies, but none of these have ever been put into practice on a large scale. No doubt this is in large part due to the fact that epidemics are too likely to recoil on those who attempt to spread them, but it is also due to the fact that biology is the science of life rather than of death, and that medicine is by its very nature humanitarian rather than the opposite.

And yet military medicine is one of the very potent factors in modern wars, but it is always employed to save life rather than to destroy it. To be sure it is employed chiefly in saving the lives of friends rather than of enemies, but nowhere is the contrast greater between the humanitarianism of medicine and the inhumanity of war than in the medical and surgical treatment of wounded and helpless friends and foes.

This terrible conflict between the ethics of war and the ethics of medicine is especially confusing in totali-

tarian war, when whole nations, men and women and boys and girls are called upon to lend all possible aid and to give their very lives for the aims and ideals of the warring nations. Medical men have not been slow to take a leading part in this conflict. Everywhere they have given their utmost services for the success of the ideals which are at stake. The medical units which have gone out from this university have rendered most valuable services in many parts of the world; their members have labored and suffered for the cause which they represent. Those who have remained nearer home have labored with equal enthusiasm for the success of these ideals. Indeed this is a war of ideals rather than of nations, and nothing is more worth fighting for and dying for than our highest ideals. But now and always medical men recognize that above all ideals of merely national patriotism and prestige are the ideals of humanity. And so we find medical men laboring to save life and to ease suffering whether among friends or foes, thus giving practical expression to the ideal that "above all nations is humanity."

This war of ideals will be won by the better rather than by the worse, for humanism is more potent than nationalism; truth and justice and liberty more enduring than falsehood, injustice and slavery; love and peace more universally demanded than hate and war. The ethics of medicine is thus in a peculiarly favorable position to influence the peace and the state of society after the war, for if this war is not to be fought and won in vain, the ideals of humanity must prevail in shaping the peace and the world to follow.

The world needs more statesmen and lawyers and educators and public leaders with the realism and idealism of scientific medicine. Too long have our social leaders treated the ills of society as savage medicine men, witch doctors, magicians and plain fakirs once treated the diseases of the body, trying to charm away the symptoms rather than to remove the causes of diseases. The disorders and diseases of society have natural causes and these causes must be controlled if social health is to be restored. Wars and social revolutions are man-made and they can be man-cured. May the spirit and methods of modern medicine guide our national leaders in treating this sickness of society, and may the humanitarian ethics of medicine grow and expand in all human relations!

The current discussions concerning the relative merits of socialized medicine as contrasted with individual or private practice is not so much a question of aims and ideals as of means and methods. The aims and ideals of the medical profession are now and have always been essentially altruistic and humanitarian, but there are quite naturally differences of opinion as to the best methods of putting these ideals into practice. The real question is how the advances of medical science can be made most widely available to those who need them. There is no doubt that large numbers of people now suffer and die for lack of proper medical attention. How can this sad condition be relieved most satisfactorily? For several centuries western civilization has recognized the humane duty to care for the sick, whether they are poor or rich. Hospitals have been established for all classes and conditions of men at first by private charity and more recently by public taxation. Health and sanitation are now recognized as of such vital concern to society that they have been cared for by public means if private provisions have been insufficient or lacking, but the need of additional medical services is still very great. Society in general now realizes that the health of the people is as important as their education. Indeed in respect to the welfare of a nation medicine and education stand on essentially similar ground, both must be provided for, either by private or by public means.

Education was formerly a private and individual concern. Those who could not find means to attend private schools were compelled to remain unschooled. Then came the free school system, supported by general taxation, for all who were unable to attend private schools, or who preferred the public schools. Finally came universal compulsory attendance on schools, whether public or private. There are certain advantages of private schools over public ones. Pupils can usually have more individual attention from their teachers, schools can be chosen which are better suited to the individual peculiarities of pupils, the individuality of both pupils and teachers can be better safeguarded in private schools than in public ones. On the other hand, there are certain advantages in public schools, apart from their being available to all the people, for they place especial emphasis on training for the duties of citizenship and for the democratic way of life.

Similar conditions are found in the private as compared with the public services of medicine, and for the present, in both education and medicine, there is room and need for both private and public systems. But there are strong currents at present making for the greater socialization of both education and medicine. The Russian social revolution has affected all nations, and now this world-war for democracy and against autocracy and special privilege is likely to affect both education and medicine in a new world order after the war. We may expect that men and women who have served and suffered for the ideals of democracy will not readily abandon those ideals when they return to civil life.

Our leaders have assured us that we are fighting

for the four freedoms—freedom of religion and of speech, and freedom from want and from fear. Freedom from want means not only from want of food, clothing, shelter for all, but also freedom from the want of medical services for all who need them. Freedom from fear not only from fear of foreign aggression, but also from fear of poverty, sickness and helplessness. Through many centuries and in many countries this struggle for freedom has been going on and much progress has been made. The present world crisis is perhaps the greatest as it is certainly the most wide-spread of all the battles for freedom.

In the matter of freedom from the fear of many epidemics, such as smallpox, the black death, yellow fever, diphtheria, typhoid, etc., medical science has largely conquered helpless and irrational fear. To-day fears of cancer, poliomyelitis, heart disease are wide-spread, but when their causes are more fully and generally known irrational fears will be relieved, even if their prevention and cure have not been solved. For example, in the epidemic of infantile paralysis in 1916 many towns and villages established shot-gun quarantine against all transportation of persons under sixteen years of age. In the 1890's similar quarantines were set up against all persons coming from yellow fever districts. Medical science has in large part removed such irrational fears even if it has not established unfailing cures of these diseases or means of their prevention. We fear most those things which are mysterious, "the pestilence that walketh in darkness," the causes of which are unknown.

But the want and need of medical attention and skill on the part of the population in general is more important than their relief from fears. The enormous amount of preventable sickness and incapacity for useful work is one of the greatest if not the very greatest of all social problems. This problem must be attacked realistically. In addition to private practice, supplemented by public hospitals and clinics, there must be increased facilities for taking the results of medical science to those who need them most, and if this is not or can not be done by the age-old method of private practice it will necessarily be done by some system of public or socialized medicine. For universal medical service is a social necessity and can not be indefinitely postponed.

I congratulate you who are to-day admitted into the ranks of this honorable profession. May you bring to it the skill and resources of modern science and the altruism and idealism which have made medicine a humanitarian profession and not merely a business or trade.

AGRICULTURAL RESEARCH IN THE WAR AND AFTER. II

By Dr. E. C. AUCHTER

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When Knowledge is a Matter of Life or Death

So much for the fruits of past research and the answer to my second question—What is agricultural research doing now?

More than any other crisis we have ever met, this war has proved that possession of scientific knowledge is a matter of life or death. As has been pointed out, it is not an accident that we are suddenly able to increase agricultural production beyond all previous records just when it is vitally necessary; that our soldiers and civilians are adequately fed for the strain of war; that we can develop scores of new techniques and products to meet specific needs and turn out the products in huge quantities. We can do these things only because science was not caught napping but was "tooled up" and had a stockpile of scientific knowledge and experience, patiently accumulated through many years of research—and enough well-developed techniques and trained personnel organized to tackle new problems with an excellent chance of success.

Nor could such a stockpile of scientific knowledge and the necessary techniques and trained personnel be improvised over night. We would not have them if it had not been for the support given to research pertinent to agriculture in this country during the past years and decades. The war has proved that no wiser investment was ever made by the American public.

There is a lesson in this for the future. I hope no one will ever again be tempted to doubt the value of research to the point where public support is reduced, so that vigilance slackens and effort lags. For though I hope we shall never have another great war, I am also certain that if we do have one, our success will again depend in no small measure on how well equipped we are with knowledge developed in times of peace.

It is well recognized to-day that research of all kinds will have to be enlarged and accelerated in every nation that hopes either to retain or to advance its present standard of living. Science truly is one of the great frontiers of a much shrunken world, and

any nation that neglects the exploration and development of this frontier is almost certainly hazarding its future—its potential share in the fruits resulting from technological advances, if not its independent existence.

Pooling Research Suggestions

There will be a great need of research in the years ahead. If each one of us here were to sit down and try to think of all possible fields for really fruitful research in the post-war period, and then pooled the suggestions, we would come out with an impressive list. Among many things with which we shall certainly be vitally concerned are these:

(1) Improved nutrition for human beings will be one of the great objectives of the future. Home economists, biochemists, physiologists and animal nutritionists have been among the pioneers in human nutrition. It must be one of their responsibilities to expand their research and continue to provide authoritative information in this field.

(2) In the broad field of plant and animal production, there will be many problems. It would be valuable to build up a detailed, systematic world geography of soils, climatic conditions, varieties of plants and methods of plant and animal production. Much of our knowledge of the development and growth of plant and animal organisms has come from agricultural scientists; we shall be expected to advance on that front, particularly in the direction of still greater control by such methods as breeding and the use of substances that regulate growth and functions. In this connection, world exploration to obtain and then maintain plant and animal germ plasm for breeding purposes will be of decided importance. We are likely to have abundant supplies of cheap nitrogen after the war; our crop rotations and systems of farming will need to be reexamined in the light of the changed fertilizer situation. In any future additional irrigation and drainage projects that may be developed, research by engineers, soil scientists and economists should be carried on in advance so that the causes of past failures may be avoided. The increasingly close contact between countries will mean new problems of insect, parasite and disease control; how can we cope with them, and in particular adapt for civilian use the revolutionary new methods of combating insects that have been developed during the war? Research is needed leading to the development of new and improved immunizing agents for many specific animal diseases.

The nutritional quality of agricultural products will receive increasing attention. We must follow up the promising leads we now have for improving nutritional quality by the proper choice of climate, soil management, cultural practises and plant breeding. We must also continue to investigate means of conserving such quality once it has been obtained. Only about half of all the milk solids dairy farmers produce are used directly as food for human beings; how to make it possible to use more of these valuable products is a problem of world-wide interest. There are literally thousands of identified species and strains of micro-organisms, many of which might be utilized to make valuable new pharmaceuticals, foods and industrial products; would it not be worth while to make a systematic survey of the possibilities in this field, extending the work already started with certain yeasts as relatively cheap sources of protein?

(3) Research in engineering and electrical and mechanical problems will be needed more than ever for such things as the perfection of home freezers, further improvements in refrigerated transportation, developing the possibilities in air transport of agricultural products, the use of the newer building materials for farm structures and improvements in the functional adaptation of farm buildings. Might it not be possible to develop complete sets of labor-saving machinery at reasonable prices for farms of different sizes and types? Although entirely an engineering problem, much will need to be done to develop dehydration, quick-freezing and canning of foods to meet the changed needs and conditions of the post-war world. And as home economists know, we have not yet reached the limit in developing labor-saving devices for the home.

(4) Many of the problems mentioned have both immediate and long-time aspects. In addition, there are many that will be urgent as soon as the war stops and that should be solved as far as possible before that time. For example, how can we best adapt for agricultural use certain equipment that will no longer be needed for military purposes? How can we best use training camp areas —land, buildings and other improvements—for agricultural and rural industries, and especially for aiding and training returning soldiers?

(5) Hundreds of millions of tons of crop residues are produced annually on the farms of this country. We should have a more vigorous research program to exploit this tremendous resource more intelligently for soil improvement, feed and such industrial products as building materials, fuel and chemicals. Some of the products developed might be made right on the farms while others could be the basis for local industries.

(6) Last, but surely not least, we need to think seriously about much more basic research in several fields of science. I need only to point out that our knowledge of such substances as starch, proteins, lignin, hemicellulose, enzymes, hormones and vitamins is still hardly more than rudimentary.

Have agricultural scientists expanded their field to the extent that the results of their research and their contacts with other fields justify? After all, if we find out how to produce excellent plant and animal products, should we not be interested in determining how to keep them excellent and in merchandising them properly until they are consumed by either rural or urban people? Are not the problems, incomes and activities of all people who use the products of the land of considerable importance to those concerned with production? Production, utilization and all that lies between are of one piece and we have not done our full duty until an integration has been effected. Past records of performance have demonstrated

clearly that both personnel and vision for such a task are available.

The list of suggestions just made is by no means exhaustive, but it does represent pressing and important lines of work. It would take careful thought, critical judgment and evaluation by many people of experience to determine what we need to do first and most after the war. Wartime developments and the prospective needs of farmers and consumers must be continuously weighed and considered. Thinking along that line is being done in connection with cooperative efforts at post-war planning, but as much attention must be given to the natural sciences as to economics.

Post-war planning in the social sciences is, of course, very important. Many urgent problems demand attention, such as those involving desirable adjustments in land tenure, cooperative institutions, shifts of population, improvement in marketing methods and various rural social institutions. The urgency of these problems, however, serves to emphasize the need for the closest possible integration of planning and research in all the sciences, natural and social alike, and a careful avoidance of too great compartmentalizing, or departmentalizing, of the planning and the implementing of the plans. There is also need for careful thinking and planning with respect to methods of extending the results of research to industry as well as to agriculture, particularly as they pertain to the utilization of farm products.

New Opportunities and Responsibilities

Agricultural research after the war can no longer be concerned with the needs of the United States alone; it must relate our needs to world conditions. This will be true whether or not there is close post-war collaboration among many countries. It will be doubly true if any such plans for cooperation are put into effect as those discussed at the United Nations Conference on Food and Agriculture held at Hot Springs earlier this year. The delegates at Hot Springs paid a great deal of attention to agricultural science. If a permanent organization results from the conference, as now seems likely, agricultural science must be given critical attention in its work.

I am not going to discuss the work of the Hot Springs conference except to point out briefly the bearing it may have on the development of agricultural research in the future. The essence of the recommendations made at Hot Springs is this:

Agricultural science has reached the point where we can say with some certainty that, given the right conditions, the world can produce enough food to eliminate starvation and raise populations to a considerably higher level of nutrition. At the same time, nutritional science has reached the point where we know what people need, not only to escape deficiency diseases but to bring about very great improvements in the physical conditions of masses of people in every country. What is needed to achieve these results—which are included in the broad objective of freedom from want—is closer integration of various aspects of agriculture and nutrition; the adoption by nations of food production and distribution policies aimed at getting adequate food to all their people; and collaboration among nations to achieve cooperative planning, expanded trade, and so on.

The Hot Springs recommendations envisage a gradual expanding of agricultural production all over the world, and this in turn would involve a gradual modernization of production methods, some reorientation of agriculture to produce enough of the foods needed, better distribution of agricultural products and comprehensive plans and studies to achieve better nutrition.

It would not be possible to do any of these things, and especially to expand, modernize and reorient production, without constant use of agricultural science. Knowledge of improved production, processing and storage methods, and assistance in adopting them, would have to become much more widespread, especially in certain countries. Research would be needed to solve scores of problems that would arise in every country and region. There would be a greater need than ever for scientists of high ability and capacity in various fields to serve in agriculture, where they would have opportunity and freedom to carry on research of the utmost significance to human welfare and would also be needed as consulting experts in the case of broad economic and social policies.

In other words, we are certain to have a world in which agricultural science will play an even more positive and dynamic part than it has in the past; and if recommendations such as those made at Hot Springs are carried out, even very gradually, by a permanent international organization, agricultural science will be consciously used, on a scale never before attempted, to help bring about world-wide freedom from want—and more lasting peace.

That will be both an immense responsibility and an immense opportunity to serve individual nations and mankind as a whole. Are we ready to accept such an opportunity? I believe we are. Agricultural science has done much to shape the world we live in. It is playing an important part in the solution of our present problems. It is ready, able and eager to make the greatest possible contribution in the post-war world.

OBITUARY

JOSEPH JASTROW
1863–1944

JOSEPH JASTROW, emeritus professor of psychology at the University of Wisconsin and widely known as a psychologist, died in his eightieth year at Stockbridge, Massachusetts, on January 8, 1944. He was born in Warsaw, Poland, on January 30, 1863, the son of the Reverend Marcus and Bertha (Wolfsohn) Jastrow.

He was graduated at the age of nineteen in 1882 from the University of Pennsylvania, from which institution he also was granted a master's degree in 1885. In 1885 he held a fellowship in psychology at the Johns Hopkins University, where the first laboratory of psychology in America and the second in the world had been organized two years before. He received his doctor's degree in 1886. Two years later he married Rachel Szold, a devoted helpmeet until her death in 1926.

He was called to the University of Wisconsin in 1888 as professor of experimental and comparative psychology (the title soon changed to professor of psychology) with instructions to organize a psychological laboratory. Virtually all his long service as a teacher was given to this institution, though he held a lectureship at Columbia University in 1910, and, on his retirement from the University of Wisconsin in 1927, was a lecturer in the New School for Social Research in New York City for six years from 1927–1933. He was in charge of the psychological section of the World's Columbian Exposition at Chicago in 1893. At the opening of the psychological laboratory at Wittenberg College in 1928, the degree of LL.D. was conferred upon him.

Professor Jastrow was a charter member of the American Physiological Society organized in 1887 and was the next to the last of its living founders. He was a fellow of the American Association for the Advancement of Science and vice-president of Section H in 1891. He was one of twenty-six charter members of the American Psychological Association organized in 1892 and its first secretary, 1892–1893. He was elected president of the association in 1900 and in his presidential address selected and defended two problems of psychology as of the greatest significance: the study of animal behavior as the primer of human behavior, and applied psychology "not for analysis alone but for practical yardstick purposes." He emphasized the wide extension of measurements of mental processes and capacities beyond psychophysics and reaction time, the study of abnormal psychology for the light it might throw on normal phenomena, and the admission of psychology on an equality into the fraternity of sciences. Of the two major problems the second engaged his interest and attention throughout his life and notably in the sixteen years after his retirement from the University of Wisconsin as an active teacher, as is indicated in the many volumes that he published.

Professor Jastrow possessed a keen, incisive mind and an extraordinarily facile pen. In addition to numerous and frequent contributions to scientific journals on psychological problems and joint authorship in several monographs, he published the following books: "The Time Relations of Mental Phenomena," 1890; "Fact and Fable in Psychology," 1900; "The Subconscious," 1906; "The Qualities of Men," 1910; "Character and Temperament," 1915; "The Psychology of Conviction," 1918; "Keeping Mentally Fit: A Guide to Everyday Psychology," 1928; "Piloting Your Life: The Psychologist as a Helmsman," 1930; "Effective Thinking," 1931; "The House that Freud Built," 1932; "Wish and Wisdom," 1934; "Sanity First," 1935; "The Story of Human Error" (editor and contributor), 1936; "The Betrayal of Intelligence," 1938.

In the last volume there appears what seems to have been the keynote of his life as a psychologist in the injunction, "Be critical—critical in what you accept, critical in whom you follow as authority." He was early an ardent foe of pseudo-scientific applications of psychology as is indicated in one of his best-known books, "Fact and Fable in Psychology." The volumes since 1928 grew out of syndicated newspaper articles and adventures in broadcasting, giving critical and sound advice on psychological matters. He was equally vigorous in his criticism of "isms" in psychology and the various so-called schools of psychology that did nothing but create confusion and chaos. In recent years he also sketched but did not fully expound a naturalistic conception of psychology based on the known or reasonably conjectured facts of neurology which he hoped would bring cosmos out of the present persisting chaos. It is a matter for regret that he did not elaborate his "naturalistic approach and scheme of psychology" for which he expressed great hope and confidence.

V. A. C. HENMON

UNIVERSITY OF WISCONSIN

RECENT DEATHS

DR. SANFORD R. GIFFORD, since 1929 professor of ophthalmology at Northwestern University, died on February 25. He was fifty-two years old.

THE REVEREND FRANCIS JAMES DORE, S. J., head of the department of biology of Boston College, died on February 28 in his sixty-eighth year.

DR. FRANK LAWRENCE COOPER, instructor in physics at Yale University, died on February 25 in his sixty-ninth year.

DR. HARRY FLETCHER BROWN, vice-president of E. I. du Pont de Nemours and Company, who from 1904 to 1911 was director of the department for smokeless powder, died on February 28 in his seventy-seventh year.

PERLEY J. BUCHANAN, director of Process Development and Chemical Control of the American Agricultural Chemical Company, died on February 23 at the age of sixty years.

DR. JAMES BRODBECK, president and chairman of the board of the Society of Chemical Industry at Basle, Switzerland, died on February 26 at the age of sixty-one years.

SCIENTIFIC EVENTS

SCIENTIFIC RESEARCH AND INDUSTRY IN GREAT BRITAIN

RECOMMENDATIONS are made by the London Chamber of Commerce in a report on scientific and industrial research, which was adopted at a recent meeting. *The Times*, London, states that

The report was submitted by a special committee, appointed on June 8 last year, "to ascertain in what manner the chamber could assist in promoting research in industry." The chamber has reached the conclusion that in order to galvanize research in this country into full and fruitful activity there are three basic essentials: A centralized and planned direction, through a Central Research Board, a far greater stream of money flowing into research, and a larger, better trained, and better paid staff.

The report suggests that the proposed Central Board should act as a coordinating and directing body for all research organizations, and be the link between the Government and the research activities of the country at large. The need for better facilities for specific research on behalf of the small firm is held to be evident.

The Central Research Board should have the right to intervene and require research associations, in consideration of the public funds placed at their disposition, to undertake fundamental research in directions which it judges to be in the national interest, and to require greater activity on the part of associations, which, in its view, are proving unequal to their responsibilities. It should be the duty of the board to consider the effect on national trade and industry as a whole of discoveries of a fundamental nature, and to direct the use of those discoveries so that they may be of the maximum advantage to the nation.

Dealing with finance, the Chamber believes that the universities, as the bodies entrusted with the vital task of carrying on pure research, should maintain a far larger staff than at present of graduates and of skilled laboratory technicians. It is recommended that the number of research fellowships at the universities should be substantially increased.

The Chamber strongly supports the Parliamentary and Scientific Committee in its recommendation that a sum of £10,000,000 should be spent over the first five post-war years in equipping and enlarging university laboratories, and that the program, estimated before the war to cost £12,000,000, to increase the provision of technical and art colleges and to expand and bring up-to-date those already in existence, should be carried out.

EXHIBIT OF THE ACADEMY OF SCIENCES OF THE U.S.S.R. AT THE LIBRARY OF CONGRESS

AN exhibition portraying the history and activities during the last twenty-five years of the U.S.S.R. Academy of Sciences has been placed on display in the Library of Congress.

Founded by Peter the Great in 1724, the academy to-day consists of approximately 136 academicians, more than 30 honorary academicians, about 224 corresponding members and over 5,000 scientific and technical assistants. Sixteen American scientific workers are now honorary or corresponding members of the academy. The portraits of some of the more prominent academicians have been included in the exhibition through the cooperation of the Embassy of the U.S.S.R. Representative volumes of the more important works by members of the academy have been selected for display from the extensive collection of Russian materials in the Library of Congress, probably the richest to be found in any library in the Western Hemisphere.

The organization of the academy groups its activities in eight departments, to each of which a section of the exhibit is devoted: the departments of physico-mathematical, chemical, geology-geographical, biological and technical sciences; history and philosophy, economy and law, and language and literature. Under these eight departments, the academy maintains 76 institutions, 11 laboratories, 47 stations, 6 observatories and 24 museums. There are also eight branches of the Academy of Sciences throughout the Soviet Union, under the supervision of which are 39 institutes, 28 stations, 3 astronomical observatories, 8 botanical gardens, 3 sanctuaries and 17 other scientific research establishments. The exhibit includes publications issued by each of the departments of the academy and some of its branches.

The peace-time work of the academy was suddenly interrupted on June 22, 1941, when Germany invaded Russia. From the very beginning of the invasion,

the academy readjusted its activities to place its resources fully behind the war effort. Even while Moscow was under heavy German attack, the publication of journals and texts was continued. Books printed while the city was under Nazi bombardment are among those shown in the display.

Under the direction of the academy, chemists have pioneered in manufacturing synthetic rubber, in photochemistry, in developing winter lubrications for tanks and planes, in producing new explosives and in extending the uses of helium. Soviet geologists have turned their energies to the problem of supplementing the stock of raw materials required by the Russian war machine, and agronomists have increased the productivity of agriculture. Physiologists and physicians have won international fame for their treatment of shock, tetanus, gangrene and other war maladies, and dietitians have found new nutritive substances, as well as new sources of vitamins, which have been used to help to solve the food problems resulting from the war. Technologists have also scored notable successes in finding substitutes for scarce materials, in simplifying technological processes and perfecting the organization of war industries. Most of these activities are represented in one way or another by publications on display.

Exhibited items of particular interest include the first book published by the academy in 1728 at St. Petersburg, the "Commentarii academiae scientiarum imperialis petropolitanae," pictures of the first building of the academy in Leningrad, its present home in Moscow, to which it moved in 1934, and the architect's drawing of its proposed new building; numerous publications of various scientific establishments attached to the general assembly and current periodicals concerning the academy as a whole. It is interesting to note that, while the publications are published mainly in Russian, a number have been published in English as well, while others have titles and summaries in English. M. V. Lomonosov (1711–1765), whose portrait appears in the historical section of the exhibit, is described as "probably the most interesting figure in the whole existence of the academy."

AWARDS OF THE BRITISH GEOLOGICAL SOCIETY

IT is reported in *Nature* that the Council of the Geological Society has announced the following awards:

The Wollaston Medal to Professor V. M. Goldschmidt, professor of geology, Frederiks University and Museum, Oslo, for his outstanding contributions to Norwegian petrology, and his fundamental researches into the structure of crystals and the distribution of the chemical elements in the earth.

The Murchison Medal to Professor V. C. Illing, of the Imperial College of Science and Technology, for his talented contribution to oil geology and Palaeozoic stratigraphy.

The Lyell Medal to Dr. N. R. Junner, of the Geological Survey of the Gold Coast and Sierra Leone, for his contributions to the stratigraphy of the Pre-Cambrian and his discoveries of valuable minerals associated therewith.

The Wollaston Fund to A. G. Brighton, curator of the Sedgwick Museum, Cambridge, for his services to paleontology and his researches on the echinoderms.

The Murchison Fund to G. M. Stockley, of the Geological Survey, Tanganyika Territory, for his work on the stratigraphy, paleontology and mineral resources of East Africa.

The Lyell Fund, one moiety to Dr. S. Buchan, of the Geological Survey of Great Britain, for his work on underground water resources of the London area, another moiety to E. W. J. Moore, of Haslingden, for his researches on carboniferous goniatites.

IN MEMORY OF CHARLES BENEDICT DAVENPORT

THE Executive Committee of the board of directors of the Long Island Biological Association, at its meeting on February 28, 1944, passed the following resolution:

Be it resolved, That the directors of the Long Island Biological Association record with a sense of irreparable loss the death, on February 18, 1944, of Dr. Charles Benedict Davenport.

Among the foremost of American men of science, Dr. Davenport was for forty years a resident of Cold Spring Harbor. From 1898 until 1923, he served as director of the Biological Laboratory, and from 1904 until 1934 as director also of our neighbor organization, the Department of Genetics of the Carnegie Institution of Washington. To a greater extent than any other individual, he was, indeed, the founder of both these institutions.

Retirement from executive responsibility brought no slackening in the interest and labor of Dr. Davenport for the cause of the Biological Laboratory. Throughout periods of discouraging outlook, of disappointment and deep personal sorrow, no less than during the happier years, he held faith in the importance and assured success of our common aim. As Secretary of the Board from 1923 until his seventy-eighth year, Dr. Davenport maintained his health and enviable vigor, his sound judgment, foresight, complete self-effacement. Among all his fellow-workers and neighbors his memory will stand no less for high attainment than for an abiding example of integrity, helpfulness and warmth of heart.

Be it further resolved that a copy of this resolution be sent to the members of Dr. Davenport's family.

The Executive Committee decided also to ask the members of the association, as well as friends and colleagues of Dr. Davenport, for contributions to a Charles Benedict Davenport Memorial Fund, the interest of which will be used for aiding scientific research in the biological field.

SCIENTIFIC NOTES AND NEWS

On the occasion of the one hundred and forty-ninth anniversary of the founding of Union College the doctorate of laws was conferred on Joseph W. Barker, dean of the Faculty of Engineering of Columbia University, special assistant to the Secretary of the Navy.

An honorary doctorate of engineering was conferred on Charles F. Wagner, manager of the central station engineering department of the Westinghouse Electric and Manufacturing Company, at the fiftieth anniversary convocation on February 21 of the Illinois Institute of Technology. The citation reads: "For pioneering research in the application of symmetrical components to power system analyses; for his outstanding contributions to the modern theories of synchronous and induction machine performance; and for his leadership in the investigation of natural lightning phenomena and the application of knowledge regarding lightning to the protection of electrical systems."

Dr. William M. Whyburn, professor of mathematics at the University of California at Los Angeles, has been elected a correspondent of the National Academy of Exact, Physical and Natural Sciences of Lima, Peru.

The Council of the Royal Aeronautical Society, London, has elected Group Captain F. Whittle a fellow of the society, in recognition of work of great importance in aeronautics.

Sir Henry Dale, president of the Royal Society, director of the laboratories of the Royal Institution, London, was presented on January 13 with the Hanbury Memorial Medal of the British Pharmaceutical Society.

The honorary gold medal of the Royal College of Surgeons, London, was presented at the Buckston Browne luncheon at the college on February 12 to W. H. Collins, chairman of King Edward VII Hospital, Windsor, in recognition of his gift of £100,000 to endow the department of pathology, with provision for a further like sum to extend and develop the department of pathology at Lincoln's Inn Fields and to found there a chair of human and comparative pathology.

The Harrison Lectureship Medal was presented on February 10 to Dr. Arthur James Ewins, F.R.S., at the House of the Pharmaceutical Society of Great Britain. Following the presentation Dr. Ewins delivered the Harrison Memorial Lecture on "Progress and Problems of Chemotherapy."

P. M. S. Blackett, F.R.S., Langworthy professor of physics in the University of Manchester, has been appointed president of the British Association of Scientific Workers, which now has a membership of nearly 15,000.

Dr. Frank S. Lloyd, professor of education at New York University and executive director of the division of physical fitness of the Federal Security Agency, has been appointed chairman of the department of hygiene of the College of the City of New York.

Dr. Kenneth C. Reynolds, associate professor of hydraulics in charge of the river hydraulic laboratory of the Massachusetts Institute of Technology, known for his work in hydraulic engineering, has been appointed head of the department of civil engineering at Cooper Union with the rank of professor. He succeeds Professor Edward S. Sheiry, who has resigned. Dr. Reynolds is now on leave of absence from the Massachusetts Institute and is in charge of a special investigation of waves for the Bureau of Ships under the Oceanographic Institution at Woods Hole.

At Temple University, Philadelphia, Dr. Wilbur Emory Burnett, professor of clinical surgery at the School of Medicine, has been appointed professor of surgery to succeed Dr. William Wayne Babcock, who has become professor emeritus; Dr. Thomas Harold Davis has been appointed to succeed Dr. Robert F. Ridpath, professor of laryngology and rhinology; Dr. John Franklin Huber to succeed Dr. John B. Roxby, professor of anatomy; Dr. Robert H. Hamilton, Jr., to succeed Dr. Melvin A. Saylor, professor of physiologic chemistry; Dr. Morton J. Oppenheimer to succeed Dr. Joseph G. Hickey, professor of physiology, and Dr. Lowrain E. McCrea to succeed Dr. William Hershey Thomas, professor of urology.

Dr. R. V. Truitt has resigned as professor of zoology and agriculture at the University of Maryland to devote his full time to the enlarged program of the Department of Research and Education at Solomons Island, Md., of which he is director.

Dr. Michael Levine, biologist in charge of the Cancer Research Laboratory of Montefiore Hospital, New York, has been appointed assistant director. He assumed his new work on March 1.

Dr. William H. Headlee, head of the division of tropical medicine and parasitology at the School of Medicine of Indiana University, Indianapolis, will leave during the present month to conduct a study of tropical diseases in Guatemala, Honduras and Costa Rica, under the auspices of the Association of American Medical Colleges and the Markle Foundation in cooperation with the army medical corps.

At the Kansas State College, Dr. H. E. Myers, pro-

fessor of soils, has leave of absence for two years to serve as agricultural adviser to the State Department. In his absence Hugh G. Myers, agent for agronomy at the Garden City Substation, has been made associate professor of soils. Dr. Roger C. Smith, head of the department of entomology, has leave of absence to serve as allocations specialist in the biological sciences and agriculture for the War Manpower Commission.

The second annual Robert J. Terry Lecture of the Dr. William T. Coughlin Foundation was given on December 21 in the auditorium of the St. Louis Medical Society by Dr. Henry Pinkerton, professor of pathology in the School of Medicine of St. Louis University. His subject was "Typhus, Rocky Mountain Spotted Fever and other Rickettsial Diseases."

Professor Harley J. Van Cleave, of the department of zoology of the University of Illinois, was the speaker at the science section of the Oklahoma Education Association, which met in Oklahoma City from February 16 to 18. His address was entitled "Returning Service Men—A Threat to National Health." He also gave an illustrated lecture on the "Biological Aspects of Conservation."

Dr. Otto Loewi, research professor of pharmacology at the New York University College of Medicine, delivered on March 28 the Rothschild Lecture at Beth Israel Hospital on "The Chemical Transmission of Nervous Impulse."

Dr. Henry R. Kraybill, director of the research laboratory of the American Meat Institute, professorial lecturer at the University of Chicago, will lecture for the Ontario Research Foundation at the March meeting of the Toronto Chemical Association. His lecture will be entitled "The Spectral Analysis of Fats."

Sir Harold Spencer Jones, Astronomer Royal of Great Britain, will deliver the 1944 May Lecture of the Institute of Metals. His subject will be "Metals in the Stars."

The Friday evening discourses for the present season at the Royal Institution, London, include one on "Brain Rhythms" by Professor E. D. Adrian, F.R.S.; one on "The Medical and Surgical Achievement of Soviet Russia in War," by E. Rock Carling, and one on "Habit and Evolution," by Professor D. M. S. Watson, F.R.S. In addition the following courses of lectures have been announced: "Modern Developments in Dairy Science," by Professor H. D. Kay; on "Fungi and Modern Affairs," by J. Ramsbottom; on "The Mode of Action of Some Vitamins," by Professor A. R. Todd, F.R.S.; on "Chemical Factors in Nervous Effects," by Sir Henry Dale, P.R.S.; and on "Food Fads and Food Fallacies," by Sir Jack Drummond.

The Rockefeller Foundation has made an appropriation of £1200 for bio-chemical investigations of penicillin under the direction of Professor Howard Walter Florey, F.R.S., professor of pathology at the University of Oxford.

Twenty-two postgraduate fellowships for research in the field of chemistry for the academic year 1944–45 have been provided by E. I. du Pont de Nemours and Company. Appointments to these fellowships, which amount to $750 each, will be made later in the year by the heads of the departments of chemistry of the several colleges and universities to which grants have been made.

Grants amounting to $35,600 have been made by the Research Foundation of the Ohio State University, of which Dr. A. R. Olpin is executive director, to stimulate and foster research in the basic sciences. These are $10,000 for Research Foundation fellowships in the Graduate School; $10,000 for research on nuclear x-ray sources; $5,000 for research in applied mathematics; $5,000 for research in electronics; $5,000 for surgical and medical research; and $600 for a technical assistant in zoology and entomology. The Research Foundation was established in 1937 as a non-profit corporation, to serve as a contractual and administrative agency for researches conducted under contract in university laboratories, with both private and government support. It also handles all patent matters for the university. The foundation has acquired control of many valuable inventions of a patentable nature and has licensed manufacturers to operate under the patents. Income from royalties and other earned income is set aside in a research reserve to foster new cooperative research programs.

Post-war plans for teaching and research in tropical medicine are now being formulated at the DeLamar Institute of Public Health of the School of Medicine of Columbia University, of which Dr. Harry S. Mustard is director. A substantial beginning has been made, further expansion is looked for in the near future, and peace-time developments comprehend new buildings, laboratories and an expanded faculty. An intensive program of graduate instruction in tropical medicine is being provided this spring, and it is expected that in the near future a full year's work will be offered to properly qualified students. In a statement issued by Dr. Mustard he points out that as a component of the College of Physicians and Surgeons, the DeLamar Institute of Public Health provides a foundation for tropical medicine that is essential. There is already available most of the basic resources necessary. In addition, Columbia University, through its relationships with the School of Tropical Medicine in Puerto Rico, is in position to provide advanced students with intensive work in a tropical environment.

THE results of a nutrition survey of Palestine are described in *The Lancet*. The survey shows that there is little obvious undernourishment in Palestine. A Health Department Survey has already shown that part of the urban population is suffering from malnutrition due to poverty. The rural population is believed to be better off now than ever before. The survey is covering the whole country and taking account of both Jewish and Arab communities; it is linked with the school-feeding scheme for Arab children in the larger towns. Children of both groups have suffered more from malnutrition than adults. The most serious dietary deficiencies are of fats and calcium, especially among Arab children. The Jewish school-feeding scheme has improved the nutrition of poor Jewish children and it is hoped that the government plan for providing school meals for Arab children will have an equally good effect. There was less vitamin deficiency than had been expected, since vegetables and fruit in season offer a good source of many of them. Iron deficiency is commoner among the Jews than among the Arabs, who use more iron-containing plants in cooking. An educational campaign, to encourage vegetable growing and conservative cooking, is proposed. Poor housing and high rents contribute to poverty and hence to malnutrition.

DISCUSSION

A NOTE ON THE SEROLOGICAL ACTIVITY OF DENATURED ANTIBODIES

ERICKSON and Neurath have recently given a brief account[1] of their studies of the change in activity, as shown by the precipitation reaction with the homologous antigen SSSI, of horse antipneumococcus antibody when subjected to the denaturing action of guanidine hydrochloride. They observed that their preparations after treatment with the denaturing agent were able to form precipitates with the homologous antigen. They attributed this ability to the regeneration of antibody in the absence of antigen, and suggested that this indicates that "the difference between antibody globulin and normal globulin is not merely one of steric arrangement but probably one of amino acid composition." We believe that a reasonable alternative interpretation of the experiments can be given.

The argument of Erickson and Neurath depends on the implied assumption that in their experiments all the antibody activity of the preparation was initially destroyed by the denaturing agent. This assumption, however, is not supported by direct experimental evidence. Our interpretation of the observations, which does not include this assumption, is the following: We assume[2] that parts of the antibody molecules have such a folding of the polypeptide chains as to give them structures complementary to the homologous antigen, and that the specific activity of the antibody resides in these parts. Under the influence of a denaturing agent such as guanidinium ions an antibody molecule may undergo structural change (unfolding of polypeptide chains, breaking of hydrogen bonds, "denaturation") in any one of many different ways, some of which may and others may not affect the parts of the molecule with specific combining power for antigen; thus the molecule may undergo "denaturation" either with or without destruction of its specific combining regions. Unfolding of polypeptide chains, whether or not it affected the specific combining regions, would lead to some polymerization and decreased solubility; and accordingly it is not a sound assumption that, if antibody structure is due to specific folding of polypeptide chains, decrease in solubility must be accompanied by loss of antibody activity.

On this interpretation the "regenerated antibody" of Erickson and Neurath would consist of those antibody molecules which had escaped extensive unfolding under the action of the denaturing agent, whereas the "irreversibly denatured antibody" would consist of aggregates of partially unfolded molecules, of such size as to be insoluble in saline solution at the isoelectric point but soluble in 2 per cent. sodium thiocyanate solution. The power of combining with antigen shown by each of these fractions we attribute to the presence of undestroyed specific combining regions on the molecules or aggregates. Evidence indicating that the process of destruction of the specific combining regions of antibody molecules by denaturing agents is slow has been obtained in an experimental study of the destruction by urea of the antitoxin activity of diphtheria antitoxin which has been in progress in these laboratories during the past year; an account of the results obtained so far will be published soon.[3]

This picture of the phenomenon suggests that changes should occur in the combining ratio of antibody and antigen, as observed by Erickson and Neurath. It is clear from this point of view that the amount of specifically precipitable protein in a treated antibody preparation can not be taken as a true mea-

[1] J. O. Erickson and H. Neurath, SCIENCE, 98: 284, 1943.

[2] See L. Pauling, *Jour. Am. Chem. Soc.*, 62: 2643, 1940.

[3] G. G. Wright, *Jour. Exp. Med.*, in press.

sure of the number of undestroyed specific combining regions, that is, of the remaining antibody activity. It is our opinion that methods such as the neutralization of toxin by antitoxin are more satisfactory than the precipitation reaction for following the destruction of antibody activity.

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Linus Pauling
Gates and Crellin Laboratories of Chemistry
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GENERAL BIOLOGY

The discussion of Report number 15, of the U. S. Office of Education, in a recent number of Science,[1] brings into contrast two points of view about "biology." Professor Alexander no doubt believes that biology is some sort of unit in the fields of knowledge. Biology has often been represented to be a subject similar to chemistry, with various aspects, to be sure, just as in the case of chemistry. All the discussion of general biology, as contrasted with other sciences, shows a fundamental misconception of its nature. The existence of the word "biology" does not mean that there is a well-unified science which can be so designated. Biology can not be set down beside chemistry, physics, mathematics, etc., as on an equal footing with them. The term which is correlative to "the biological sciences" is "the physical sciences." Would it be an improvement to the teaching of physics, chemistry, mathematics, meteorology, geology, astronomy, etc., to concoct an extraction of all of them, and present it as a preferred introduction to those fields?

Most of us from our own experience must believe that it is necessary to treat mathematics by itself, as perhaps the most fundamental science; and that the other physical sciences are best presented in major courses dealing with their own material in their own way. They do not neglect mathematics, but supplement it, and put it to use in innumerable ways. The biological sciences have long been sinned against, even by our highest bodies of scientists, by trying to coerce them into some kind of hodge-podge unit. It is an encouraging sign that the U. S. Office of Education has found courage to print the report of the committee. Too long have the courses in general biology been a fraud against the student. Botany is a unified subject, coordinate with chemistry. Zoology also is a unified subject coordinate with chemistry. Either of these life sciences has as many subdivisions of its material as are found in *Chemical Abstracts,* for instance.

A better day will dawn for the biological sciences when it is fully recognized that there is no such thing as a science called "biology," any more than there is a science known as "physical science." These expressions represent great groups of sciences, and it is no wiser to present "general biology" instead of botany and zoölogy, than to present "physical science" in lieu of mathematics, physics and chemistry. The general biologists have been fooling themselves and the world of education far too long.

C. A. Shull
The University of Chicago

[1] Science, n. s., 99: 78–80, 1944.

APPEARANCE OF MENDEL'S PAPER IN AMERICAN LIBRARIES

There has been considerable interest among geneticists since the turn of the century in the "rediscovery" of Mendel's epoch-making studies of the laws of inheritance. Mendel's well-known paper, "Versuch Ueber Pflanzen Hybriden," was published in Volume 4 of the Naturforschender Verein, Brünn, Austria, in 1865. It would be interesting if we knew all the reading Mendel did of the writings on inheritance and also the contacts he made both personally and by letter with contemporary scholars interested in heredity. Morgan (Science, page 262, 1932) rightly places emphasis upon what had been learned as to the inheritance of characters in the pea by Goss and Knight 42 years before the above paper by Mendel was published. Naudin's studies also antedate Mendel's work by two years or so.

Mendel's paper apparently remained unknown to most of that group of European workers in near-by countries who would have best understood the significance of his results. It remained for the geneticists of a later generation to find and evaluate Mendel's work. Frequent mention has been made of the "rediscovery" of Mendel's paper in 1900 by deVries, Correns, Bateson and Tschermak. To the credit of American geneticists note should be made of the fact that L. H. Bailey included a reference to Mendel's work in a paper on cross breeding and hybridizing in 1892. DeVries learned of Mendel's work from this bibliography (see "Plant Breeding," by Bailey and Gilbert, page 155, 1915). Bailey was using the Harvard Library from 1881 to 1885 while working with Asa Gray but had learned of Mendel's work from reading Fooke rather than from seeing Mendel's paper direct.

Since one sometimes detects a slight note of reproach from American geneticists because European workers had overlooked Mendel's work for so long it occurred to the writer that it would be of interest to know when and where Mendel's paper might have been available in American libraries before 1900. To this end it was noted that in the second edition of the Union List of Serials (1943) 21 libraries list Volume 4 of the Brünn Society. Inquiry by letter to each of these libraries as to the date Volume 4 was available

for reference brought out the following rather surprising situation:

Academy of Natural Sciences of Philadelphia	1867
American Academy of Arts and Sciences, Boston	1867
Boston Society of Natural History	1867
U. S. Army Medical Library, Washington, D. C.	1871
Harvard University Library	1878
Yale University Library	1882
Library of Congress and Smithsonian Institution	1883
U. S. Department of Agriculture, Library	1896
New York Public Library	1897
Columbia University Library	1898

This list may not be complete and does not, of course, include possible personal copies which may have been sent at that time direct to individual American scientists.

M. J. Dorsey

University of Illinois

CONTINUATION OF THE PROGRAM OF THE INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

In 1943, the writer published "An Index to the Opinions of the International Commission on Zoological Nomenclature."[1] Publication of the index was preceded by an extended correspondence (1934 to 1943) with the late Dr. Charles Wardell Stiles, formerly secretary of the commission, and officials of the Smithsonian Institution, which published Opinions 1 to 133. Typescript of the index was placed in the hands of the publishers early in March, 1943, and the material was in type when Science for July 2, 1943, carried the first note which had come to the writer's attention regarding continuation of the Opinions by the International Commission through its publication office in London.

In a letter from Mr. Francis Hemming, secretary of the commission, under date of January 4, 1944, the writer's attention was directed to certain statements in the introduction to the index which were held to contain "inaccurate and damaging statements regarding the position of the International Commission." The statements thus referred to included an honest, if possibly unsound, expression of doubt as to the possibility of future continuation of the programs of the congress and the commission because of factional difficulties which seemed to threaten effective operation of either the congress or its commission on nomenclature. Evidence to the contrary was not available at the time the manuscript was prepared.

It is now obvious that the obstacles to further co-operative effort were not insurmountable. The commission began an independent program of publication of additional opinions in 1939, and thanks to the industry and vision of the members of the commission, and especially its secretary, Mr. Hemming, "The Bulletin of Zoological Nomenclature" was established in 1943 as a clearing house on problems of zoological nomenclature.

The university library placed a standing order for both the *Bulletin* and the *Opinions* immediately upon receipt of information regarding their availability in July, 1943, but because of obvious transportation difficulties the first issues of the *Bulletin* were received in November and the first shipment of the *Opinions* came through in January.

Through the *Bulletin* it is a matter of record that beginning in 1939 an active program of publication of *Opinions* beyond the 133 incorporated in the index was well under way and that by October, 1943, *Opinions* 134 to 147 had been issued and eleven additional opinions rendered by the commissioners had not yet been given publication. However, knowledge of the existence of the *Bulletin* and of the start of the new volume of *Opinions* was not generally available to American zoologists until the July 2, 1943, issue of Science carried the memorandum by Dr. James E. Peters.

It is with the deepest appreciation that American zoologists view the continuation of the international cooperation in nomenclature. Any misleading statements which the writer may have made regarding cessation of such activity were unintentional reflections of personal opinion, inadvertently inaccurate because facts to the contrary were not available at the time the Index was prepared.

Harley J. Van Cleave

University of Illinois

SCIENTIFIC BOOKS

GARDEN ISLANDS

Garden Islands of the Great East. Collecting Seeds from the Philippines and Netherlands India in the Junk "Cheng Ho." By David Fairchild. 239 pp. Many illustrations. New York: Charles Scribner's Sons. 1943.

The reviewer of David Fairchild's new book is somewhat in the position of one required to describe, in prose, the merits of a poem. It is impossible, in a brief account, to do justice to the excellence of the narrative and the interest of the topic. The Malay Archipelago of Wallace, in spite of all the changes due to man, still includes many islands, and parts of islands, in their original condition, full of new or little-known plants and animals. The Malay flora is extraordinarily rich in species of woody plants, and

[1] *Amer. Midland Nat.*, 30(1): 223–240.

as regards its genera and larger groups is of great antiquity. The fossil fruits of the London Clay in England, dating back many millions of years, show that formerly many of the plants growing on the islands of the East were represented in Europe by unmistakable relatives. Climatic changes have driven this flora to a more limited region, while the multitude of islands has favored the development of many local species.

Fairchild supposed that his collecting days were over, but his friend, Mrs. Archbold, became interested in a collecting expedition to the Moluccas, and it was arranged for Thomas Kilkenny to build a Chinese junk in Hongkong, in which they would explore the islands, searching for plants and seeds, to be grown in the warm parts of North America, especially Florida. The project was to be kept secret even from their intimate friends, but it leaked out and many letters came warning the Fairchilds against making such a dangerous journey at their age. They felt, however, that precisely because they were older the world could spare them more easily if they never returned. As it turned out, there were no very serious dangers or discomforts, and they managed to get out, sooner than they had intended, before the Japanese invasion. They gathered over five hundred different kinds of plants, including over ninety species of palms. The region, in strong contrast with Africa, is extremely rich in palms, and as so many of these will now be grown from seed in Florida, it will be possible to study their characters very much better than could be done from herbarium material. "Already the Fairchild Tropical Garden boasts a collection of about 250 species of palms . . . a Palm Products Museum . . . and the Liberty Hyde Bailey Palm Glade is in the making."

After a brief visit to Japan, the Fairchilds went to the Philippines. Three chapters are entitled "Thatched Cottage in the Philippines," "With the Foresters of Luzon" and "Highland Sojourn." The junk came to Manila, and at the beginning of 1940 they were off to the islands known collectively as the Netherlands Indies, visiting the southern Philippines on the way.

"The Isle of Singing Children" describes a visit to the islands of Siaoe, which appears as a tiny dot on the chart, yet has on it volcanoes 5,800 and 3,600 feet high. The Radja gave a song festival in honor of the Fairchilds:

> I was not present, but Marian reported that when her turn came she could not think of a single song, and to cover her embarrassment, the Radja's wife started "Merrily we roll along," and the whole company carried it on in English. What made it surprising was that the guests were all natives of Siaoe. There wasn't a European on the island. . . . As the *Cheng Ho* bore us out past the smoking cone of Goenoeng Api, and past Mt. Tamata, the sweep of coconut landscape was so beautiful, the memories of our stay among the charming people were so pleasant, that I think all of us felt we would like to return sometime to the island of the singing children. Are they still singing under Japanese invasion, I wonder? Where they came from, these light-colored, gay-people, nobody knows.

So on to Celebes, to Java, to Bali, to Amboina and other places, always with exciting plant discoveries and charming human contacts. The famous botanical garden at Buitenzorg in Java was of course visited. Here it was that Fairchild, a young man of twenty-five, first worked in the tropics, "and now, in April of 1940, I was walking there alone, forty-six years later and on my seventy-first birthday." While Fairchild collected plants, Mrs. Fairchild and Mrs. Archbold collected shells. The large collection of shells was taken to the Museum of Comparative Zoology at Harvard University, and will undoubtedly prove of great scientific interest.

As we read about these lovely islands, and their marvelous flora, they seem to belong to another world. Yet with modern means of transportation, they can be reached in less than two weeks from the United States, and no doubt will be once the war is over. There is some danger here, that the wrong people may go. The Fairchilds, in their attitude toward the inhabitants, their pleasure in the scenery, their understanding of the plants, were just the people to get the most out of such a journey; there is perhaps no one living who could equal them. It should be one of the prime aims of education to cultivate understanding and appreciation of foreign lands and a love of the beauties of nature.

The very numerous illustrations in the book, from photographs, help us to understand the text; they are selected from some thousands taken. The book closes with these words, written in the early dawn at Miami:

> The birds are twittering in the trees. The scene before me changes every moment. And there is Marian, standing beside me. Dawn has broken, and we sit and think of those other dawns in the other places of the earth where we have been. We are back home again among the living souvenirs of our years of travel, and knowing that we must close this book we have written, Marian suggests that we might close it here where we began it—under the Java Ficus tree where now one of those carved stone images of Bali has found a resting place.

Perhaps the old man only fell asleep and rambled through the "Groote Oost," and, waking, found that what he told about was nothing but a dream.

T. D. A. Cockerell

Desert Museum,
Palm Springs, Calif.

SOCIETIES AND MEETINGS

HONORS AND PRIZES OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

ONE of the colorful events which always dignifies the annual meetings of the American Society of Civil Engineers is the presentation of honors and prizes. The event this year occurred on Wednesday morning, January 19, 1944, in the auditorium of the Engineering Societies Building, 33 West 39th Street, New York City.

The first prize awarded was given to Thomas E. Stanton, recently vice-president of the society, for his paper on "Expansion of Concrete through Reaction between Cement and Aggregate." This prize is the oldest and highest within the gift of the society. It has been awarded for over sixty years. Mr. Stanton's paper dealt with the physical consequences that may result from chemical reaction between high alkali cement and certain mineral constituents of aggregate. It provides an adequate explanation of a number of startling cases of concrete deterioration that have occurred in coastal regions. The engineering profession, the concrete industry and the users of concrete in general are benefited by the studies recognized in the award of this prize.

Next in the list of prizes was the J. James R. Croes Medal, named in honor of the first winner of the Norman Medal. This year the medal was awarded to Carl R. Gronquist, associate member of the society, a bridge engineer with the New York firm of Robinson and Steinman. His contribution was entitled "Simplified Theory of the Self-Anchored Suspension Bridge," and appeared together with other prize-winning papers in the 1942 volume of the society's "Transactions." The type of structure described differs from the ordinary suspension bridge in that the horizontal pulls of the cables at the ends are resisted by the structure itself rather than by the abutments. The new theory lends itself to a straightforward and expeditious analysis. Although the suspension bridge has occupied the spotlight during recent years, the self-anchored form has not enjoyed great prominence because of the complexity of its analysis. Mr. Gronquist's work, therefore, is of practical and immediate value.

Next was the Thomas Fitch Rowland Prize, named for its donor, a former officer of the society, to memorialize outstanding papers describing construction of engineering works. It was awarded this year to Paul Baumann, member of the society, for a paper on "Design and Construction of San Gabriel Dam No. 1." Because of the scarcity of dam sites distinctly favorable for masonry structures, engineers are faced more and more with the problem of constructing dams at locations far from ideal. The solution in the case considered by Mr. Baumann was an adaptation of a type known as the rock-fill dam to meet special local conditions. In addition to a discussion of design and construction, he gave a full analysis of the materials and correlated his laboratory tests with actual field construction experience to an admirable degree.

Another experience with a dam was illustrated in the award of the James Laurie Prize, which was given to Thomas A. Middlebrooks, associate member of the society, for a paper on the "Fort Peck Slide." Perhaps no part of the technical responsibility of the American Society of Civil Engineers is so important as the free and open discussion of civil engineering failures. This paper is based on tests and analyses conducted on the soil and rock at the dam site, as bearing on the disastrous slide that occurred in September, 1938. The particular value of the paper is in that it focuses attention on the results of studies conducted after the slide to determine its cause and to outline a method of repair.

The Arthur M. Wellington Prize commemorates one of the society's great thinkers in the field of transportation and economics. This award went to Milton Harris, associate member of the society, for a treatment of the topic, "Traffic Engineering as Applied to Rural Highways." This paper sets up basic points of view relative to the modernization of highway facilities as well as the design of new highways, showing that the engineering study should recognize the practical use of the highway as well as the engineering provision for specific needs utilizing stated materials. Major Harris, formerly of the California Department of Highways, is now in service in North Africa.

Somewhat different in character is the Collingwood Prize for Juniors, limited to the younger members of the society. The winners were Ray K. Linsley, of the U. S. Weather Bureau in Sacramento, and William C. Ackermann, of the Tennessee Valley Authority, Knoxville, Tenn. Their joint paper was entitled "Method of Predicting the Runoff from Rainfall." The subject is one of much interest to engineers. The merit of the paper lies in the fact that it develops methods of computing values of runoff in advance, which agree quite favorably with the observations for actual storms. These researches therefore have a practical application.

The Construction Engineering Prize is under the construction division of the society and is awarded yearly for the best paper on construction appearing in

the society's journal, *Civil Engineering.* Carlton B. Jansen, member of the society, engineer of the Dravo Corporation in Pittsburgh, received the award for a most interesting paper on "Submerged Shipways with Steel Sheeting Walls," describing a recent installation of great engineering interest in Wilmington, Del.

Another prize under the auspices of a society division rather than the society as a whole is the Karl Emil Hilgard Prize, in memory of a celebrated Swiss engineer who lived for many years in America. The hydraulics division of the society determined that this prize should go to Professor Harold A. Thomas, member of the society, of the Carnegie Institute in Pittsburgh, and Emil P. Schuleen, associate member, of the U. S. Engineer Office, in the same city. Their paper was entitled "Cavitation in Outlet Conduits for High Dams." Cavitation is the mechanical deterioration, in this instance of concrete, due to high water pressures and velocities. Two types of apparatus for studying cavitation are described, with analysis of the results, and a development of the hydraulic theory involved.

The last award for engineering studies was made to George J. Schroepfer, member of the society, chief engineer of the Minneapolis-St. Paul Sanitary District, for a paper entitled "Experiences in Operating a Chemical-Mechanical Sewage Treatment Plant." This paper received the Rudolph Hering Medal at the hands of the sanitary engineering division of the society. This medal commemorates a famous American engineer. The paper describes the problems that arose in the first two years of operation of a new plant, the expedients developed to overcome the difficulties, and further changes to effect economy or simplification. The results have a direct appeal to sanitary engineers faced with similar practical problems.

Four celebrated American engineers were awarded honorary memberships, highest recognition among American civil engineers. Best known of these men was Thomas H. MacDonald, for many years head of the government roads program, now the Public Roads Administration in Washington. Another well-known engineer is Francis T. Crowe, who has been construction superintendent on Boulder, Shasta and other huge western dam projects. Gerard H. Matthes is well known among American civil engineers for his outstanding work in the fields of river hydraulics, surveying and geology. Still another new honorary member is Edward H. Connor, long a leader in the field of large bridge construction and difficult deep foundations.

In their presentation for these distinguished honors, the new honorary members were accorded the following citations:

EDWARD HANSON CONNOR: Long a leader in the contracting field, attacking difficult bridge and foundation problems; whose character and integrity have earned success in a most hazardous engineering business.

FRANCIS TRENHOLM CROWE: Construction engineer specializing in tremendous dams; whose masterworks have brought protection to flood-stricken valleys, vital power to great industrial centers and life-giving water to a thirsty land.

THOMAS HARRIS MACDONALD: Pioneer in American transportation engineering, devoting a lifetime to distinguished public service; through whose clear vision and administrative powers the world's greatest highway development is being consummated.

GERARD HENDRIK MATTHES: Happy combination of Dutch and American training; master of many engineering fields, now lending great talents to solving the hydraulics of the Mississippi River; cultured gentleman who honors a great profession.

At the same meeting the following newly elected officers were installed: *President,* Malcolm Pirnie, New York City; *Vice-Presidents,* Richard E. Dougherty, New York City, and Franklin Thomas, Pasadena, Calif.; *Directors,* S. C. Hollister, Ithaca, N. Y.; Gail A. Hathaway, Washington, D. C.; R. W. Gamble, Milwaukee, Wis.; Wilbur M. Wilson, Urbana, Ill.; Frank C. Tolles, Cleveland, Ohio; William D. Shannon, Seattle, Wash., and Royce J. Tipton, Denver, Colo.

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SPECIAL ARTICLES

THE POSSIBLE SYNTHESIS OF BIOTIN FROM DESTHIOBIOTIN BY YEAST AND THE ANTI-BIOTIN EFFECT OF DESTHIOBIOTIN FOR L. CASEI[1]

RECENTLY the yeast-growth-promoting activity of desthiobiotin has been described, together with an improved method for its preparation from biotin by hydrogenolysis with Raney nickel.[2] Desthiobiotin was found to be equally as effective as biotin in stimulating the growth of *Saccharomyces cerevisiae,* but could not replace biotin as a growth stimulant for *Lactobacillus casei.* These differences in the growth-stimulating properties of biotin and desthiobiotin for

[1] The authors wish to express their appreciation to Mrs. Glenn Ellis and Miss Carol Tompkins for carrying out the bioassays.

[2] V. du Vigneaud, D. B. Melville, K. Folkers, D. E. Wolf, R. Mozingo, J. C. Keresztesy and S. A. Harris, *Jour. Biol. Chem.,* 146: 475, 1942. D. B. Melville, K. Dittmer, G. B. Brown and V. du Vigneaud, SCIENCE, 98: 497, 1943.

yeast and *L. casei* suggested their utilization as a differential biological assay method for the determination of biotin and desthiobiotin in systems containing either or both compounds.

The surprisingly high yeast-growth activity of desthiobiotin raised the question of whether desthiobiotin was a yeast-growth factor *per se* or showed activity because of a conversion to biotin by the yeast cell. With a differential assay method available it became possible to investigate this problem, and the results of some experiments in this direction are described herein.

TABLE 1

YEAST AND L. CASEI ASSAY VALUES OBTAINED WITH BIOTIN AND DESTHIOBIOTIN, SEPARATELY AND IN COMBINATION, AND AFTER AUTOCLAVING IN ACID SOLUTIONS

Growth stimulant added	Total amount of stimulant added	Yeast assay biotin and desthiobiotin values	L. casei assay biotin values
		γ	γ
Biotin	1.00 γ	1.01	1.02
Desthiobiotin	1.00 γ	1.00	0
Biotin 0.5 γ } Desthiobiotin 0.5 γ }	1.00 γ	0.96	0.52
Biotin, autoclaved*	1.00 γ	0.98	0.96
Desthiobiotin, autoclaved*	1.00 γ	0.37	0
Moist yeast, autoclaved*	1.0 gm	0.72	0.67
Desthiobiotin } Moist yeast, autoclaved* }	6.33 γ } 1.0 gm }	2.12	0.67

* 1 hour at 120° C. with 2 *N* H_2SO_4.

The growth effects of pure biotin and desthiobiotin, alone and in combination, were first determined on cultures of *S. cerevisiae*.[3] A mixture of biotin and desthiobiotin showed an additive effect on the growth of this yeast, as shown in Table 1.

Biotin and desthiobiotin, singly and in combination, were tested for their growth effects on *L. casei* ε[4]. At concentrations of desthiobiotin lower than 0.47×10^{-7} molar, the growth produced by mixtures of the two compounds was identical with that produced by the biotin present alone, as shown in Table 1. This permitted the use of this method for differentiating between biotin and desthiobiotin in mixtures of the two.

However, it was observed that at concentrations of desthiobiotin higher than 0.47×10^{-7} molar, desthiobiotin possessed a definite anti-biotin effect toward *L. casei*. The growth of this organism due to 0.82×10^{-10} molar biotin was decreased to one half its value by the addition of 2.3×10^{-6} molar desthiobiotin prior to incubation. This inhibition of growth by desthiobiotin was completely reversed by increasing the biotin concentration to 4.1×10^{-10} molar. The use of the yeast-*L. casei* differential method of assay for desthiobiotin in biological materials is not complicated by the anti-biotin effect of desthiobiotin if the concentrations of desthiobiotin are not greatly in excess of 0.47×10^{-7} molar. In the following experiments sufficiently low concentrations of desthiobiotin are used to prevent the anti-biotin effect from playing an appreciable role in the assays.

Since preliminary acid hydrolysis was used to liberate any bound biotin in the yeast cultures, the effect of acid hydrolysis on the activity of desthiobiotin and of desthiobiotin and yeast mixtures was investigated. These results, also included in Table 1, show that while treatment of biotin with 2 N H_2SO_4 at 120° for 1 hour has no effect on its growth-promoting activity, the same treatment of desthiobiotin destroys between 60 and 80 per cent. of its yeast-growth activity. It is evident from these results that in fractions exhibiting growth activity for *L. casei,* and not affected by acid hydrolysis, this activity could not be due to desthiobiotin, but could be due to biotin.

In experiments designed to determine the possible formation of biotin from desthiobiotin used as a growth stimulant for yeast, 40 cc of biotin-free medium were inoculated with 2.4 mg of moist yeast from 24-hour culture of *S. cerevisiae* (Strain 139) and added to various amounts of desthiobiotin in 125 cc pyrex Erlenmeyer flasks. These cultures were incubated at 30° C. for either 16 or 46 hours. At the end of the incubation period, the cells were separated from the medium by centrifugation. The medium was autoclaved without acid for 15 min-

TABLE 2

DATA OF SEVERAL TYPICAL DESTHIOBIOTIN CONVERSION EXPERIMENTS

Compound added	Amount added	Inoculum per 40 cc.	Incubation period	Yeast assay (biotin plus desthiobiotin) Cells	Yeast assay Medium	Yeast assay Percentage of amount added	L. casei assay (biotin) Cells	L. casei assay Medium	L. casei assay Percentage of amount added	Amount of desthiobiotin converted
	γ	mg.	hrs.	γ	γ	Per cent.	γ	γ	Per cent.	Per cent.
Desthiobiotin	0.1212	2.40	16	0.1130	0.0025	95	0.1130	< 0.0008	93	100
Desthiobiotin	1.212	2.40	16	0.1315	1.016	95	0.1540	< 0.0008	13	13
Desthiobiotin	1.212	2.40	46	0.185	0.889	90	0.216	< 0.0025	18	18
Biotin	0.1217	2.40	16	0.1212	< 0.0004	99	0.100	< 0.0008	83	..

[3] E. E. Snell, R. E. Eakin and R. J. Williams, *Jour. Am. Chem. Soc.*, 62: 175, 1940.

[4] G. M. Shull, B. L. Hutchings and W. H. Peterson, *Jour. Biol. Chem.*, 142: 913, 1941.

utes, while the cells were autoclaved at 120° C. for 1 hour in 2 N H_2SO_4. The solutions from the autoclaved cells were neutralized, adjusted to volume and filtered to remove any precipitate. Both the autoclaved medium and the acid-hydrolysed cells were assayed for yeast-growth-promoting activity, which represents activity due to both biotin and desthiobiotin, and *L. casei* growth-stimulating activity, which is a measure only of biotin or some other biotin vitamer which has been synthesized by the yeast and which is capable of supporting the growth of *L. casei.*

The data of several typical desthiobiotin conversion experiments together with a biotin control are presented in Table 2. These results show that desthiobiotin disappears from the incubating yeast cultures and is replaced by an equivalent amount of a substance possessing growth-promoting powers for *L. casei.* The most logical assumption is that desthiobiotin is transformed to biotin by the growing yeast cell.

As can be seen in Table 2, the conversion of desthiobiotin is not complete with increasing amounts of desthiobiotin added, even with the longer incubation period. Apparently only sufficient amounts of desthiobiotin are converted to supply the needs of the growing cells. This is also borne out by our finding that resting yeast did not convert any measurable amount of desthiobiotin to biotin. Increased concentrations of other components of the growth medium did not affect the conversion. The use of such a biological synthesis of biotin, from the relatively easily synthesized desthiobiotin, on a preparatory scale might be feasible with micro-organisms which could convert larger amounts of desthiobiotin to biotin.

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THE ANTI-BIOTIN EFFECT OF DESTHIOBIOTIN[1]

According to Melville, Dittmer, Brown and du Vigneaud[2] *Lactobacillus casei* does not grow when desthiobiotin replaces the biotin of the medium, whereas *Saccharomyces cerevisiae* strain 139 grows readily. Through the courtesy of Dr. R. T. Major, of Merck and Company, the writers secured a sample of desthiobiotin and by using 45 biotin-requiring organisms confirmed and extended the findings of Melville *et al.* The results show that the biological effect of desthiobiotin could be classified into the following four groups according to the responses of the individual organisms:

1. *Desthiobiotin replaced biotin* for 25 strains of *Saccharomyces cerevisiae,* for *Saccharomyces chaudati, S. macedoniensis, Endomycopsis fibuliger, Debaryomyces matruchoti v. subglobosus, Mycoderma valida, Mycotorula lactis, Schizosaccharomyces pombe, Torula lactosa, Zygosaccharomyces marxianus, Zygosaccharomyces lactis, Neurospora crassa, N. sitophila, Ceratostomella ips 438, C. Montium* and *Leuconostoc mesenteroides.*

2. *Desthiobiotin did not replace biotin* for *Ceratostomella pini* 416, *Sordaria fimicola, Lactobacillus casei, L. arabinosus* and *Rhizobium trifolii* 205.

3. *Desthiobiotin did not act as anti-biotin* in the presence of an exogenous supply of biotin for *Lactobacillus arabinosus* and *Rhizobium trifolii.* These were not inhibited by 1,000 micrograms of desthiobiotin and 0.025 microgram of biotin per liter; in fact, *L. arabinosus* showed nearly a threefold increase in growth over the controls, and a still greater growth when desthiobiotin was augmented to 4,000 micrograms per liter. This stimulation may be ascribed to one of the following two causes: either this organism is able to utilize a certain amount of desthiobiotin in the presence of biotin, or else the sample of desthiobiotin at our disposal carried biotin as impurity. However, it is doubtful if there was enough biotin to support so much growth, otherwise why did this organism fail to grow when no biotin was added to desthiobiotin?

4 *Desthiobiotin acted as anti-biotin* for *Sordaria fimicola, Ceratostomella pini* 416 and *Lactobacillus casei.* The first one of these three organisms may be considered a borderline case: it averaged 45 milligrams of dry mycelium per flask in the presence of 0.1 microgram of biotin per liter; when 250 micrograms of desthiobiotin was added to this amount of biotin, the yield went up to 83 milligrams, but when desthiobiotin was increased to 4,000 micrograms per liter and the amount of biotin remained the same, the yield dropped back to 44 milligrams per flask. *Ceratostomella pini* 416 showed a more clear-cut effect of anti-biotin action. It averaged 34 milligrams of dry mycelium per flask in the presence of 0.25 microgram of biotin per liter; upon the addition of 2 micrograms of desthiobiotin per liter, the yield increased to 50 milligrams per flask. But when desthiobiotin was increased to 1,000 micrograms per liter, the yield dropped to 12 milligrams per flask.

Table 1 gives the responses of *Lactobacillus casei* in detail.

Failure of *Lactobacillus casei* to grow whenever

[1] Published with the approval of the director of the West Virginia Agricultural Experiment Station as Scientific Paper No. 326.

[2] D. B. Melville, K. Dittmer, G. B. Brown and V. du Vigneaud, Science, 98: 497, 1943.

TABLE 1

THE GROWTH OF LACTOBACILLUS CASEI IN THE PRESENCE OF VARYING AMOUNTS OF BIOTIN, DESTHIOBIOTIN, AND COMBINATIONS OF THE TWO, AFTER 72 HOURS AT 37° C.

Micrograms biotin per liter	Photometer readings	Micrograms desthiobiotin per liter	Photometer readings	0.025 micrograms biotin per liter, varying amounts desthiobiotin	Photometer readings	2,500 micrograms desthiobiotin per liter and varying amounts of biotin	Photometer readings
0.0	4.5	0.0	4.5	0.0	19.0	0.0	5.0
0.015625	15.0	0.015625	11.0	7.181	22.0	0.0125	3.0
0.03125	22.0	0.03125	6.0	15.625	20.0	0.025	3.0
0.0625	34.0	0.0625	7.5	31.25	19.0	0.05	6.0
0.125	53.0	0.125	7.5	62.5	18.0	0.1	8.0
0.25	64.0	0.25	7.5	125.0	14.0	0.2	22.0
				250.0	11.0	0.4	56.0
				500.0	13.0	0.8	60.0
				1000.0	9.0	1.6	62.0
				2000.0	5.0		
2,500.0	70.0	2,500.0	4.0	4000.0	4.0		

desthiobiotin was added to the biotin can not be ascribed to the effect of the high concentration of this substance in the medium because the organism made an excellent growth in the presence of 2,500 micrograms of biotin. An examination of the last two columns of Table 1 furnishes more conclusive evidence of the anti-biotin effect of desthiobiotin. While smaller amounts of biotin failed to overcome the blocking effect of desthiobiotin within the time limit of the experiment, larger quantities readily neutralized the anti-biotin effect of this substance. Even after an incubation of 24 hours, 0.4 microgram of biotin per liter effectively overcame the effect of 2,500 micrograms of desthiobiotin.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A RAPID METHOD FOR MAKING PERMANENT MOUNTS OF MOSQUITO LARVAE

MOSQUITO larvae as well as other soft-bodied insects are frequently mounted on glass slides for taxonomic study and permanent safekeeping. There are several common mounting methods, plus numerous variations now being used by mosquito taxonomists. Rather serious disadvantages, however, are encountered in the use of three of the most commonly used techniques.

Canada balsam is an old and excellent mounting medium, but the generally accepted technique of dehydration in alcohols and clearing in xylol frequently results in a collapsed, brittle specimen with many lost and broken hairs. In addition the use of this technique requires a great deal of time, since the clearing process is usually quite lengthy.

Euparal is another resin frequently used, but it is now almost impossible to obtain and if obtainable is quite expensive. To secure best results with the use of this material, specimens should be placed in ethylene glycol mono-ethyl ether (Cellosolve solvent) before being mounted in euparal.

Many workers advocate mounting in an aqueous medium such as Berlese's chloral gum solution or one of its modifications. By the use of this substance specimens may be mounted directly from water after being killed. This is an excellent temporary medium, but it should not be used for permanent mounts because it evaporates badly, hardens very slowly, and even if the cover slip is ringed it will frequently evaporate and ruin the slide. This medium also tends to discolor after a period of a few years.

A technique has been worked out at this laboratory which eliminates many of the above disadvantages and results in a permanent preparation. The procedure is as follows: larvae are killed in hot water and then placed in 70 to 75 per cent. ethyl alcohol for 10 to 15 minutes. This time may be shortened somewhat if the venter is pierced in several places with a minuten nadeln or similar fine pointed needle. The specimen is next placed in 95 per cent. alcohol for 3 to 5 minutes and from there is dropped into absolute alcohol for about 5 seconds. It is then placed in creosote U.S.P. until the specimen has cleared sufficiently. In the case of a very delicate specimen the creosote should be diluted with equal parts of absolute alcohol before being placed in undiluted creosote. The time the specimen should remain in creosote will vary but is generally only a matter of a few minutes. Several larvae may be placed in the creosote at one time and the clearest ones removed first. The specimen is finally placed on a clean glass slide, excess creosote removed, but care should be used not to touch the larva. It is then covered with Canada balsam, oriented, and the cover slip applied. If the tip of the abdomen is severed while in the balsam, the slide should be held for several days to permit the balsam to harden. The cover slip can then be applied. This prevents the severed portion from drifting and makes a more presentable mount.

A wide-mouth medicine dropper or a small curved spatula should be used to transfer the specimens and care should be used to handle them as little as possible.

This procedure is quite rapid, the ingredients are readily available, the specimens do not collapse or harden and lastly the preparation is a permanent one.

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